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## CHAPTER 10

# Procedures for the Review of Telecommunication Systems for Frequency Availability and Electromagnetic Compatibility (EMC)

## 10.0 GENERAL

### 10.0.1 Avoiding Interference

 Government agencies planning the use of, conducting experiments relating to, or developing and procuring telecommunication systems requiring the use of radio frequencies shall take all reasonable measures to ensure that such systems will neither cause nor receive harmful interference to or from other authorized users when placed in their intended operational environments. In planning telecommunication systems within the scope of this procedure, Government agencies shall develop systems for operational use in accordance with the applicable portions of the National Tables of Frequency Allocations and the provisions of this Manual, unless an exception is recommended by the Spectrum Planning Subcommittee (SPS) and approved by NTIA.

### 10.0.2 Satisfying OMB Circular A-11

OMB Circular No. A-11 specifies in Section 12.4: "Estimates for the development or procurement of major communication-electronics systems (including all systems employing satellite (space) techniques) will be submitted only after certification by the National Telecommunications and Information Administration, Department of Commerce, the radio frequency required for such systems is available." NTIA certification of spectrum support can be obtained using the procedures in this chapter. The matter of preparation and submission to OMB of

budget estimates for Government systems is covered in Section 8.2.5.

### 10.0.3 SPS Review of New Systems

To assist Government agencies in meeting the above responsibilities and to support the NTIA and the IRAC in the management of radio spectrum resources for the satisfaction of Government requirements, and in the national interest, these procedures provide for the review of certain new Government telecommunication systems and subsystems by the SPS, at a number of the stages of their evolution, prior to the assignment of frequencies. Such review will, as appropriate, require an examination of the existing systems in the frequency band(s) being considered.

### 10.0.4 FCC Participation

Full participation of the FCC in these procedures, for the review of Government systems intended for operation in bands of mutual Government/non-Government interest, occurs through the normal FCC liaison representation on the IRAC and its subcommittees.

### 10.0.5 War Emergency Conflicts

As part of its review, the SPS will identify those systems which may have EMC conflicts within the US&P during war emergency situations.

## 10.1 DEFINITIONS

### 10.1.1 Telecommunication System

A telecommunication system, for the purpose of this procedure, is a combination of facilities, stations, or circuits intended to perform an information transfer function by the use of the radio spectrum, e.g.:

- a space station and its associated earth stations for provision of meteorological information;
- a combination of aeronautical stations for communication support of air traffic control;
- an interconnected network of fixed stations;
- a combination of fixed and land mobile stations intended to provide communication support for law enforcement or protection activities on a local or area-wide basis;
- a combination of facilities intended to provide a radionavigation service; or
- a combination of facilities intended to provide a radiolocation (radar) service.

### 10.1.2 Telecommunication Subsystem

A telecommunication subsystem, for the purpose of this procedure, is a combination of facilities, stations, or circuits intended to provide telecommunication support to a broader functional telecommunication entity (e.g., the surveillance portion of an air defense system or an avionics package of a nomenclatured aircraft).

### 10.1.3 Major Terrestrial System or Subsystem

A major terrestrial system or subsystem is a telecommunication system or subsystem that does not involve the use of satellites or spacecraft, and which may have significant impact on existing or potential future use of the portion of the radio frequency spectrum in which it is intended to operate, taking into account systems of the same radio service and those of any other radio service with which the spectrum in ques-

tion is shared.

### 10.1.4 Major Modification

A major modification is any change of the technical or operational characteristics of an existing telecommunication system or subsystem which may have significant impact on existing or potential future use of the portion of the radio frequency spectrum in which it is intended to operate, taking into account systems of the same radio service and those of other radio services with which the spectrum in question is shared.

### 10.1.5 System Review

The system review is a procedure used by the SPS to develop recommendations on behalf of the IRAC for the Deputy Associate Administrator, Office of Spectrum Management of NTIA, regarding certification of spectrum support for telecommunication systems or subsystems coming within the scope of this chapter (see Part 10.2). A system can be reviewed at four stages as it matures into an operational status. These are:

1. *Stage 1, Conceptual:* The initial planning effort has been completed, including proposed frequency bands and other available characteristics;
2. *Stage 2, Experimental:* The preliminary design has been completed, and radiation, using such things as test equipment or preliminary models, may be required;
3. *Stage 3, Developmental:* The major design has been completed, and radiation may be required during testing; and
4. *Stage 4, Operational:* Development has been essentially completed, and final operating constraints or restrictions required to assure compatibility need to be identified.

(NOTE: The stages of review are discussed in greater detail in Section 10.3.1.)

## **10.2 SCOPE OF PROCEDURE**

### **10.2.1 Applicability and Limitations**

This procedure is applicable to systems and subsystems as defined in Part 10.1. It shall be limited to:

1. new telecommunication systems or subsystems, and major modifications to existing systems or subsystems, involving the use of satellites or spacecraft;
2. new major terrestrial systems or subsystems, and major modifications to existing systems or subsystems;
3. such systems or facilities as may be referred to the SPS on a case-by-case basis by the NTIA, the IRAC, the FAS, or a cognizant Government agency. Such referral may result from factors of system cost or importance, or follow from estimates of unusual potential impact on other spectrum uses.

### **10.2.2 Experimental Projects**

Experimental projects are included in this procedure.

### **10.2.3 EW/ECM Threat Simulators**

EW/ECM threat simulators are generally required by their mission to operate in bands not allocated to appropriate radio services. Such operations usually utilize special one-of-a-kind or limited sets of equipment. They usually operate at military installations specified in Parts 7.11 and 7.17. Operations are in accordance with Part 7.14. EW/ECM threat simulator frequency assignments are exempt from the provisions of Chapter 10 of the Manual. This does not preclude the review of EW/ECM threat simulators by the IRAC.

### **10.2.4 Individual Stations, Links, or Networks**

An individual radio station, an individual

point-to-point radio link, or an individual network in the mobile radio service, any of which is to become a part of an existing identified telecommunication system or subsystem, for example, will normally not be considered for the purpose of this review procedure. Application and plans for such individual stations, radio links, and services will be reviewed by the SPS only upon direct referral for cogent reasons such as given in subsection 10.2.1.3.

### **10.2.5 Individual Components**

An individual component of a system or subsystem, as defined in Part 10.1, will normally not be considered for the purpose of this review procedure.

### **10.2.6 Government Use of the Band 220-222 MHz**

Nationwide systems using the 2 designated, exclusive Government nationwide 5-channel blocks and local systems operating on the channels shared with non-Government users in the band 220-222 MHz are included in this procedure. Detailed equipment characteristics of systems that have been type-accepted by the FCC or already received by the SPS will normally not be considered for the purpose of this review procedure. However, a list of all base stations (geographic coordinates when known and site names), with antenna heights, effective radiated power, and dates of construction and bringing into use for each nationwide and non-nationwide system shall be provided to the Spectrum Planning Subcommittee for review. Justification of any implementation dates more than 1 year after the requested date of Stage 4 Certification of Spectrum Support should be included for non-nationwide systems.

### **10.2.7 Non-Licensed Devices**

Non-licensed devices will normally not be considered for the purpose of this review

procedure. Agencies can request that information on non-licensed devices be entered into the SPS data base. Any request for SPS review of a non-licensed device shall include a justification for SPS consideration of such a device.

## **10.3 STAGES OF REVIEW AND SCHEDULING**

### **10.3.1 Stages of Review**

1. *Stage 1, Conceptual:* Certification of spectrum support for telecommunication systems or subsystems at Stage 1 provides guidance on the feasibility of obtaining certification of spectrum support at subsequent stages. Those systems or subsystems that have a major impact on spectrum usage as defined by the user agencies, IRAC, or NTIA, especially those that use new technological concepts or use existing technology in significant new ways, should be submitted. The guidance provided will indicate any modifications, including more suitable frequency bands, necessary to assure conformance with the Tables of Frequency Allocations and the provisions of Chapter 5.

2. *Stage 2, Experimental:* Certification of spectrum support for telecommunication systems or subsystems at Stage 2 is a prerequisite for NTIA authorization of radiation in support of experimentation for systems that are subject to these procedures (see Part 10.2). It also provides guidance for assuring certification of spectrum support at subsequent stages. Certification at Stage 2 may be requested for test equipment, modified operational equipment, or initial design models that can be used to determine which of several frequency bands or which of several proposed equipment configurations should be selected for continued investigation.

3. *Stage 3, Developmental:* Certification of spectrum support for telecommunication systems or subsystems at Stage 3 is a prerequisite for NTIA authorization of radiation in support of developmental testing for systems that are

subject to these procedures. It also provides guidelines for assuring certification of spectrum support at Stage 4. At this point, the intended frequency band will normally have been determined and certification at Stage 3 will be required for testing of proposed operational hardware and potential equipment configurations.

4. *Stage 4, Operational:* Certification of spectrum support for telecommunication systems or subsystems at Stage 4 is a prerequisite for NTIA authorization of radiation from a station with an operational station class (i.e., other than experimental) for systems that are subject to these procedures. It provides restrictions on the operation of the system or subsystem as may be necessary to prevent harmful interference.

### **10.3.2 Scheduling of Reviews**

Systems or subsystems falling within the scope of this chapter shall be referred to the SPS in sufficient time to permit guidance to be developed by SPS and NTIA and applied by the agency. System reviews normally can be completed and spectrum support guidance can be provided within three to nine months from the date of submission to SPS. The submitter shall consider this time period and the provision of subsection 10.4.3.1 requiring the FAS to withhold frequency assignments until the assignment particulars conform to the spectrum support guidance. The time requirements for international processing of advance publication, coordination, notification, and agreement documents, as discussed in the *Manual of Instructions for Notifying U.S. Radio Frequency Assignment Data to the International Frequency Registration Board*, shall also be considered for space systems.

## **10.4 RESPONSIBILITIES**

### **10.4.1 Spectrum Planning Subcommittee (SPS)**

1. In its system reviews, the SPS shall give consideration to:

a. system compliance with prevailing spectrum management policy (both peacetime and war emergency), allocations, regulations, and technical standards (Government, National, and International);

b. the predicted degree of EMC between the proposed system and the electromagnetic environment;

c. the possible need for and evaluation of the results of prototype EMC testing; and

d. the electromagnetic compatibility of the war emergency use of systems reviewed under this chapter. The Subcommittee should review war emergency use only to assess potential incompatibility in terms of the electromagnetic environment and technical standards. (NOTE: The relevant priorities of the war emergency functions being supported by the system under consideration will be reviewed by the IRAC, not the SPS, as appropriate. The IRAC review should not be considered a part of the SPS review process.)

2. Upon assessment of a proposed system or subsystem, considering these criteria and any other pertinent factors, the SPS will make recommendations with supporting documentation to NTIA with an information copy to the IRAC, for:

a. approval of spectrum support for the system at its proposed stage of development, without qualification; or

b. approval of spectrum support subject to stated limitations or to modification of the proposed system; or

c. approval of spectrum support subject to limitations or modifications to systems already in the band; or

d. approval of spectrum support subject to submission of information for advance publication, agreement of affected foreign administrations, notices for coordination, and notification of frequency assignments for unclassified space systems, as appropriate, under the provisions of Articles 8, 11, 13, and

14 of the ITU Radio Regulations; or

e. disapproval of spectrum support.

3. Should the Subcommittee determine that there may be incompatibility in the electromagnetic environment or in technical standards among or between proposed and existing systems in a war emergency situation, the Subcommittee will:

a. advise each affected agency of the finding;

b. request that the affected agencies develop and document mutually-satisfactory solutions for the specific points of potential EMC conflict (NTIA will assist with technical analyses upon request);

c. review the recommendations of the agencies involved, or note their inability to reconcile war emergency EMC conflicts in the Subcommittee's recommendations;

d. incorporate the war emergency use recommendations made by the involved agencies into its recommendations to NTIA. Upon receipt, NTIA shall annotate the *Emergency Readiness Plan for the Use of the Radio Spectrum (ERP)* to reflect the war emergency use agreement; and

e. notify NTIA, via the IRAC, when the agencies whose systems have been identified as being technically incompatible are unable to reach agreement as to war emergency use.

#### **10.4.2 Space Systems Group (SSG) of the SPS**

1. The SSG shall review the data furnished by Government agencies regarding the advance publication, agreement with affected administrations, and coordination and notification of frequency assignments for space telecommunication systems under the provisions of Articles 8, 11, 13, and 14 of the ITU Radio Regulations. The SSG shall give consideration to:

a. the conformance of the system to the provisions of Articles 8 and 28 and Appendices 3 and 4 of the ITU Radio Regulations and applicable IFRB Circular Letters;



b. the identification of those countries from whom agreement must be obtained under the provisions of Articles 8 and 14 of the ITU Radio Regulations; and

c. the identification of those countries with whom the system must be coordinated under the provisions of Article 11 of the ITU Radio Regulations.

2. The SSG shall also review the correspondence furnished by the IFRB and by other countries regarding proposed space telecommunication systems in accordance with Articles 8, 11, 13, and 14 of the ITU Radio Regulations. The SSG will estimate the impact of foreign space systems on existing and planned Government space and terrestrial telecommunication systems and will develop appropriate replies. Information regarding foreign space systems that operate in bands shared with U.S. terrestrial stations will be furnished to the SPS for comment when it is appropriate.

3. Documents which have been approved by the SSG shall be coordinated with the Deputy Associate Administrator, Office of Spectrum Management, and provided to the ING for transmittal to the IFRB and any concerned foreign countries.

#### **10.4.3 Frequency Assignment Subcommittee (FAS)**

1. The FAS shall not recommend the assignment of frequencies to stations in systems that are subject to these procedures until notice is received that frequency support for the system has been certified. The particulars of the assignments shall conform to the terms of the system approval. Assignment applications for such stations received in the FAS prior to system review shall be tabled until the appropriate stage of the system review procedure has been completed. The FAS shall inform the SPS of this action.

2. The FAS may recommend frequency assignment action for (a) additional stations and (b) the modification of assignments to stations

in existing systems or systems approved under this procedure, provided the operations resulting from the assignment action will have only minor local effect upon the electromagnetic environment.

3. The FAS shall place emphasis on the careful review of applications involving sharing of the same frequency bands by terrestrial and space services. When necessary, the FAS may recommend to IRAC that further EMC analysis by NTIA, or other cognizant agency, be completed prior to assignment action. Any matters that cannot be resolved, and those applications for which approval could result in major effects on the future use of the frequency band concerned, shall be referred to the IRAC.

#### **10.4.4 Technical Subcommittee (TSC)**

The TSC and its working groups shall provide information from the ongoing programs in standards, criteria for spectrum sharing, propagation, trade-offs among telecommunication techniques, radio noise and interference environments, side effects of spectrum use, and Government-wide EMC capability. In addition, the TSC shall be guided in its work, scope, and priority by requirements identified by the IRAC for support of EMC reviews underway and expected in accordance with these procedures.

#### **10.4.5 Interdepartment Radio Advisory Committee (IRAC)**

The IRAC, through a designated entity (Ad Hoc 134), shall:

1. Take note of the Telecommunications Service Priority for Radiocommunications (TSP-R) as determined by a department or agency for each of its systems supporting war emergency functions approved under the provisions of this chapter.

2. Consider the war emergency function, the telecommunication system or systems which is or are to support the function, and the priority designated by the agency in relation to the func-

tion. Consideration of an agency-designated TSP-R is intended only to ensure consistency of TSP-R criteria interpretation. An assessment of the designated TSP-R in relation to other systems or functions of the submitting agency or those of other departments or agencies is not appropriate.

#### **10.4.6 Government Agencies**

1. Agencies will participate in the application of these procedures in the IRAC and its Subcommittees and shall provide information needed for the system review as specified in Parts 10.6 and 10.7.

2. IRAC representatives shall be responsible for determining within their agencies which systems come within the scope of this procedure (see Part 10.2) and should, therefore, be submitted to the SPS for system reviews. In making this determination, IRAC representatives should give serious consideration to the spectrum-related concerns of other member agencies. A system review under Chapter 10 entails consideration of a more detailed EMC analysis than is appropriate within the FAS.

3. Agencies are expected to determine the impact of any new system referred to the SPS on telecommunication systems used in support of their war emergency functions, and to provide promptly to the SPS the technical and operational details supporting the determination of a possible EMC conflict.

4. The interagency conference results called for in paragraph b of subsection 10.4.1.3 shall be provided in a timely manner.

5. Agencies will take into account recommendations provided as a result of the system review in the modification and resubmission of proposals to improve system EMC characteristics and facilitate frequency support. Agencies may recommend and will consider modifications to existing facilities and will facilitate the accommodation of new systems. Agencies may participate in EMC studies specified in Part 10.5 as an active associate to the degree required to

assure responsiveness to their requirements and responsibilities and shall be consulted to assure development of realistic assignment criteria and other technical system considerations.

#### **10.4.7 National Telecommunications and Information Administration (NTIA)**

1. NTIA will review the information submitted by the SPS in regard to apparently-incompatible war emergency spectrum requirements and determine the best means of reconciliation. Each agency involved will be notified of this determination.

2. Should one or more agencies object to the proposed NTIA reconciliation described in subsection 10.4.7.1, the agencies will report the basis for the objection to NTIA. NTIA will review the objection and attempt a final reconciliation. If the proposed reconciliation remains unacceptable to the agencies involved, the matter may be referred to the Office of Science and Technology Policy (OSTP) for its decision. The decision of the OSTP will be disseminated to the agencies involved and noted in the ERP.

3. NTIA will review the information submitted by the IRAC in regard to apparently-inappropriate TSP-R's and determine the best means of reconciliation. Each agency involved will be notified of this determination.

4. Should NTIA and the department or agency that submitted an apparently-inappropriate TSP-R conclude that the designated TSP-R is in fact appropriate or another TSP-R designation is mutually agreed to, NTIA shall notify the IRAC of the finding. If no agreement can be reached that is acceptable to the submitting department or agency, the matter may be referred to OSTP for its decision. The decision of the OSTP will be disseminated to the agency involved and noted in the ERP.

### **10.5 EMC ANALYSIS SUPPORT**

#### **10.5.1 General**

1. In reviewing and assessing the EMC and frequency availability aspects of proposed telecommunication systems, as defined herein, the SPS shall depend upon system and equipment characteristics data submitted by the proposing agency and upon available environmental information.

2. The SPS shall make use of the results of any available technical studies and any pertinent EMC analysis capabilities within Government agencies when assessing proposed systems. More specifically, the SPS shall arrange for and make use of existing EMC analysis capabilities and procedures of the DoD, NASA, and other Government agencies where they may expedite or enhance its assessment of a proposed system. Arrangement for such support will be obtained through NTIA. Moreover, the SPS shall promote the cooperative exchange of views and information among the agencies that may provide EMC analysis support to the Subcommittee.

3. The SPS will be supported by NTIA and may refer to NTIA, as appropriate, system proposals for evaluation and recommendations regarding:

- a. compliance with prevailing standards and sharing criteria;
- b. predicted degree of EMC with the environment;
- c. relative efficiency in the use of the radio spectrum by the proposed system;
- d. system modification or alternatives, including modifications to stations already operating in the band(s) in question, where appropriate; and
- e. technical solutions for systems having war emergency functions and having conflicting spectrum requirements within the US&P.

4. The SSG will be supported by NTIA and may refer to NTIA, as appropriate, U.S. and foreign space system proposals for evaluation and recommendations regarding:

- a. conformance to applicable national and international rules and regulations;

- b. predicted degree of EMC with the environment; and

- c. system modifications or alternatives, including modifications to stations already operating in the band(s) in question, where appropriate.

### **10.5.2 Types of Analysis**

1. Types of analysis will vary from a determination of gross impact on the spectrum to detailed EMC analysis. The level and complexity of analysis must depend on the quality of the data available at the various stages of system development.

2. In analyses leading to certification of spectrum support at Stage 1, Conceptual, much of the system data will be estimated, only gross calculations may be achievable for a general evaluation of spectrum impact that will be subject to adjustment during later stages. The system will be reviewed in conformance to International and National Allocation Tables. In addition, checks will be made against existing standards and sharing criteria, comparison will be made with known similar systems, and spectrum efficiency will be considered.

3. In analyses leading to certification of spectrum support at Stage 2, Experimental, the foregoing types of analysis will be applied where appropriate with more specific EMC analysis against a typical environment being added where experimental testing of technically defined equipments is involved. Recommendations for changes to equipment characteristics and contemplated operational employment/deployment will be provided, where appropriate. Calculations required in connection with national and international space coordination procedures in accordance with the methods of Appendices 28 and 29 of the ITU Radio Regulations will be performed to the extent practicable.

4. In analyses leading to certification of spectrum support at Stage 3, Developmental, more detailed EMC analyses will be performed, using measured data from experimentation

when available. Appropriate recommendations as to equipment characteristics and/or operational employment/deployment will be developed. Calculations in connection with national and international space system coordination procedures will be performed or updated as appropriate.

5. In analyses leading to certification of spectrum support at Stage 4, Operational, detailed EMC analyses will be updated, as required, to include consideration of frequency assignments for specific system deployment. Appropriate recommendations as to equipment characteristics and/or operational limitations will be provided.

### **10.5.3 Prototype EMC Testing**

When the results of EMC analyses so indicate, prototype EMC tests may be required as an input to the determination of spectrum availability and electromagnetic compatibility.

## **10.6 GENERAL DATA REQUIREMENTS**

### **10.6.1 Minimum Data Required**

Government agencies shall provide data, as appropriate and categorized below, to the SPS for review at the various stages as systems mature, in accordance with the provisions of this chapter. All of the specified categories of data that are appropriate to the system under review are required for Stages 2, 3, and 4. While no specific minimums of data are specified for a Stage 1 review, beyond the guidance provided under the various categories below, agencies should provide sufficient data to allow determination of conformance with Allocation Tables and, for space systems, conformance with power flux density limitations.

### **10.6.2 Submission of Additional Data**

The SPS may request the submission of additional data or data estimates during the course

of its system review, or may endorse direct contact between the EMC analysis support agency (NTIA or other) and the requesting agency for development of data estimates.

### **10.6.3 Upgrading of Data Previously Provided**

Agencies proposing new systems shall be responsible for the upgrading of data provided to the SPS for the earlier stages, as more valid information becomes available and as the system progresses through the various review stages to its final operational configurations.

### **10.6.4 Changes to Submissions**

Between the time an agency submits a system to the SPS for review and prior to its NTIA approval, changes or additions to the system characteristics may occur. If these changes are easily correctable, they will be inserted by NTIA in the agency's original submission document. If the changes are more extensive, the submitting agency will revise the affected forms and submit them to NTIA for incorporation in the original submission document. The purpose of this procedure is to ensure that the latest available data is included in the final NTIA system review package. All changes will be reviewed by the SPS before its recommendations to NTIA are finalized.

### **10.6.5 Selective Upgrading of Data**

The SPS may request the selective upgrading of electromagnetic environmental data for specific areas and radio services, where necessary to support realistic EMC analyses of new systems.

## **10.7 SPECIFIC DATA REQUIREMENTS**

Requests for system review shall contain the following (this data may be provided in the

alternate format specified in Department of Defense Form DD 1494):

### 10.7.1 Cover Letter

The cover letter shall contain the following information:

1. *Stage of Review Requested:* Indicate the stage of review requested.
2. *Purpose of the System:* Submit for all stages a summary description of the function of the system or subsystem (e.g., collect and disseminate meteorological data using satellite techniques; transmission of radar data for air traffic control; remote control of ATC radars).
3. *Information Transfer Requirement:* Submit for all stages the required character, quantities, data rates, and circuit quality/reliability.
4. *Estimated Termination Date* (where applicable).
5. *Estimated Initial Cost of the System:* This item is for information to show the general size and complexity of the system. It is not intended to be a determining factor in system reviews.
6. *Target Date:* Submit dates on which spectrum-related decisions must be made relative to system planning, development, procurement, and employment.
7. *System Relationship and Essentiality:* Submit for all stages a statement of the relationship between the proposed system and the function or operation it is intended to support. Include a brief statement of the essentiality to the supported function or operation.
8. *Replacement Information:* Identify the existing system(s) and associated frequency assignments to be replaced by the proposed system, where applicable.
9. *Out-of-Band Operations:* Submit a justification for any telecommunication system or subsystem that does not operate in accordance with the applicable Tables of Frequency Allocations as required by Section 10.0.1, and details of how operations on a noninterference, unprotected basis are feasible. This information

is required for systems or subsystems that must operate out-of-band in the United States, its possessions, or in space.

10. *War Emergency Function:* A statement as to whether the proposed system, if it becomes operational, will support a war emergency function.

### 10.7.2 Attachment 1

Attachment 1 to the cover letter shall provide line diagram(s) showing the links, direction of transmission, and frequency band(s).

### 10.7.3 Attachment 2 -- For Space Systems

1. *Stage 1 and 2 Requirements:*
  - a. Satellite orbital characteristics (longitude for geostationary satellites, and apogee, perigee, and inclination for non-geostationary satellites).
  - b. Satellite transmitter maximum spectral power density for each transponder.
  - c. Earth station locations (city, state, and coordinates) within the US&P, and frequencies or frequency bands used at each.
2. *Stage 3 Requirements -- For Each Earth Station Transmitter and Receiver Site:*
  - a. Frequencies or frequency bands and satellites accessed.
  - b. Coordinates.
  - c. Emission designator for each frequency or frequency band.
  - d. Maximum spectral power density and output power for each frequency or frequency band.
  - e. Lowest equivalent satellite link noise temperature and associated value of transmission gain for each frequency or frequency band (geostationary satellites with simple frequency-changing transponders only).
  - f. Antenna gain and beamwidth.
  - g. Minimum elevation angle of antenna main beam.
  - h. Range of azimuth angles.
  - i. Lowest total receiver noise temperature

(when e. is not appropriate).

3. *Stage 3 Requirements -- For Each Space Station Transmitter and Receiver:*

- a. Frequency or frequency bands and cooperating earth stations.
- b. Satellite orbital information.
- c. Emission designator for each frequency or frequency band.
- d. Peak power and spectral power density for each frequency or frequency band for transmitters.
- e. Receiver noise temperature.
- f. Transmitter antenna pattern (only if PFD limits are exceeded).

4. *Stage 4 Requirements:* In addition to satisfying all Stage 3 requirements, the following data items are required for each earth station:

- a. Horizon elevation angle diagram.
- b. Antenna altitude above ground.

5. The format for providing these data is left to the discretion of each agency. However, for unclassified space systems which have not been waived from the requirements of international registration as described in Part 3.3, similar information must be prepared in specific formats and submitted to the SSG in accordance with instructions in Part 3.3 and the *Manual of Instructions and Procedures for Notifying U.S. Radio Frequency Assignment Data to the International Frequency Registration Board*. The data required by the SSG to satisfy the specifications in Appendix 4 of the ITU Radio Regulations shall be submitted at the same time as the Stage 2 system review request, and may be used in lieu of the Attachment 2 data for Stage 1 and 2 system review requests. Data required by the SSG to satisfy the specifications in Appendix 3 of the ITU Radio Regulations shall be submitted at the same time as Stage 3 system review requests, and may be used in lieu of the Attachment 2 data for Stage 3 and 4 system review requests.

**10.7.4 Attachment 2 -- For Terrestrial Systems (all stages)**

The following information may be included in the line diagram submitted as Attachment 1 above, if desired:

1. Station class(es).
2. Number of units (for mobile systems).
3. Station locations and/or areas of operation, as appropriate (geographical coordinates required for Stages 2, 3, and 4).
4. Frequency requirements (i.e., band(s) or discrete frequencies required, bandwidth and emission designators, and netting information, where appropriate).
5. Proposed date of activation.

**10.7.5 Attachment 3 -- Related Analysis Data**

For all stages, submit reports of any previous EMC studies, predictions, analyses, and prototype EMC testing that are relevant to the assessment of the system under review, or references thereto if previously provided to the IRAC/SPS, including references to previous system reviews of the same system or its predecessors.

**10.7.6 Attachment 4 -- Equipment Characteristics:**

1. Submit completed forms NTIA-33, NTIA-34, and NTIA-35 for each equipment (transmitter, receiver, antenna) intended for use in the system under review. All applicable data items shall be completed for Stages 3 and 4 (estimated values or ranges of values may be submitted for Stage 3 in the absence of other available data). For Stages 1 and 2, provide actual equipment data, or in the absence of such data, estimated data and ranges of values shall be stated on the forms sufficient to support a realistic preliminary assessment of frequency availability and EMC characteristics.

2. NTIA forms need not be submitted for equipment whose required characteristics have been previously provided to the SPS or which are contained in the Equipment Characteristics File. In such cases, indicate in Attachment 4 the

Government nomenclature or manufacturer's model number of such equipment.

3. Instructions for the completion of the NTIA forms are contained in Sections 10.7.7 through 10.7.9 below.

### **10.7.7 Instructions for Completing the Transmitter Characteristics Form (NTIA-33)**

1. *Security Classification:* This form will be classified in accordance with appropriate agency security directions. Downgrading instructions will be indicated. The items or relationship of items which make this completed form classified will be stated in the remarks section (e.g., "The association of the frequency range and the equipment nomenclature are classified \_\_\_\_\_"). Alternatively the classification may be indicated by a (U), (C), or (S) alongside each item as appropriate.

2. *Item 1:* Enter the Government alphanumeric equipment designation. Use the official designation as it appears or will appear on the nameplate of the transmitter (e.g., T128). If a Government nomenclature has not been designated, enter the manufacturer's model number (e.g., MTT 502). If neither a Government nomenclature nor a manufacturer's model number has been designated, enter a short descriptive title (e.g., ATS-6 Telemetry Transmitter).

3. *Item 1a:* Enter the manufacturer's name. In those cases where a Government nomenclature has not been entered in Item 1, this item is mandatory.

4. *Item 2:* Enter the system nomenclature. The system nomenclature is defined as that nomenclature which has been assigned to a combination of equipments (e.g., AN/GRC-27).

5. *Item 3:* Enter the generic class or grouping of the transmitter (e.g., High Resolution, Frequency Scan, Scan While Track Radar, Time Division Link, Pulse Doppler Monopulse Tracker, Communications AM, FM, etc.).

6. *Item 4:* Enter the actual frequency range

through which the transmitter is capable of being tuned. For single frequency equipment, enter the frequency to which equipment is limited. Indicate units used (e.g., kHz, MHz, GHz, etc.).

7. *Item 5:* Enter the method of tuning (e.g., continuous, fixed, crystal synthesizer, etc.).

8. *Item 6:* Enter the total number of channels, frequency of the lowest channel, frequency of the highest channel, channel spacing, and if the device is capable of automatically hopping frequency (e.g., 10 channels, 406.125-406.350 MHz, 25 kHz spacing, with automatic frequency hopping capability).

9. *Item 7:* Enter the maximum departure of a transmitter from its tuned frequency, after normal warmup time has been allowed. Express in parts per million for all emission types, except single sideband which shall be expressed in Hertz.

10. *Item 8:* Enter the emission designator(s), as shown in Section 6.3.1 of this Manual, for the types of emission capable of being used with this transmitter.

11. *Item 9:* For all transmitters except HF SSB, enter the emission bandwidths for which the transmitter is designed at the -3, -20, and -60 dB levels. The bandwidth at -40 dB shall also be entered for pulse radar transmitters. The emission bandwidth is defined as that appearing at the antenna terminals, and includes any significant attenuation contributed by filtering in the output circuit or transmission line. Values of emission bandwidth specified should be indicated as calculated or measured by checking the appropriate block. Indicate units used (e.g., kHz, MHz, etc.). For spread spectrum, frequency hopping, doppler techniques, etc., enter full details in Item 21, Remarks. For HF SSB transmitters, provide three plots of the emission spectrum using the measurement method described in Section 5.4.1 D. These plots should be made at the transmitter frequencies of 3 MHz, 12 MHz, and 28 MHz.

12. *Item 9(a):* Occupied bandwidth is defined as the frequency bandwidth such that, below its

lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total power radiated by a given emission. (Required for DoD agencies only.)

13. *Item 10:* Check the appropriate block to indicate the absence of or the type of filter employed. The characteristics of the filter shall be provided in Item 21.

14. *Item 11:* Enter the maximum information bit rate for digital equipment, in bits per second. If spread spectrum is used, enter the bit rate after encoding.

15. *Item 12:* For frequency or phase modulated transmitters, enter the maximum modulation or baseband frequency. This frequency is assumed to be the frequency 3 dB on the high-frequency side of the modulator response curve. Indicate the units used (e.g., Hz, kHz, etc.).

16. *Item 13:* For frequency or phase modulated techniques, check the appropriate block to indicate whether preemphasis is available.

17. *Item 14:* For frequency or phase modulated transmitters, enter the deviation ratio computed with the formula:

$$\text{Deviation Ratio} = \frac{\text{Maximum Frequency Deviation}}{\text{Maximum Modulation Frequency}}$$

18. *Item 15:* Enter the power delivered to the antenna terminals in (a) carrier power for A3E sound broadcasting in the broadcasting service, (b) mean power for all other amplitude modulated emissions using unkeyed full carrier, and for all FM emissions, and (c) peak envelope power for all classes of emission other than those referred to in (a) and (b) above, including A3F television and all pulsed emissions.

19. *Item 16:* For pulse modulated transmitters:

a. *Item 16(a):* Enter the pulse repetition rate in pulses per second.

b. *Item 16(b):* Enter the pulse width at the half voltage levels in microseconds.

c. *Item 16(c):* Enter the pulse rise time in microseconds. This is the time required for the leading edge of the pulse to rise from 10% of its peak amplitude value (voltage) to 90% of its

peak amplitude value.

d. *Item 16(d):* Enter the pulse fall time in microseconds. This is the time required for the trailing edge of the pulse to fall from 90% of its peak amplitude value (voltage) to 10% of its peak amplitude value.

e. *Item 16(e):* Enter the maximum pulse compression ratio, if applicable.

20. *Item 17:* Enter a description of the device used in the transmitter output stage (e.g., ceramic diode, reflex klystron, varactor multiplier, triode, etc.).

21. *Item 18:* Enter the maximum value of spurious emissions (dB) which occur outside the -60 dB point on the transmitter fundamental emission spectrum (Item 9) and do not occur on a harmonic of the fundamental frequency.

22. *Item 19:* Enter the harmonic level relative to fundamental in -dB of the 2nd and 3rd harmonics. Enter in Item 19c the relative maximum level in  $\pm$ dB of all harmonics above the 3rd.

23. *Item 20:* Enter the FCC Type Acceptance Number if this transmitter has been type accepted by the FCC.

24. *Item 21:* Use this space to amplify any of the information provided above. Particular emphasis should be placed on a thorough explanation of the emission characteristics. This information might include equipment multiplexing capabilities and additional details of composite systems (a "9" in the emission designator). If spread spectrum is utilized, describe in detail. This item should be used to provide additional information which may be useful in assessing the electromagnetic compatibility of this equipment. Technical limitations integral to the equipment which limit its performance over the frequency range, the use of specified emissions, or radiated power should be explained. For devices capable of automatically hopping frequency, indicate whether channels or band segments may be locked out.

## 10.7.8 Instructions for Completing the Receiver Characteristics Form (NTIA-34)



1. *Security Classification:* This form will be classified in accordance with appropriate agency security directions. Downgrading instructions will be indicated. The items or relationship of items which make this completed form classified will be stated in the remarks section (e.g., "The association of the frequency range and the equipment nomenclature are classified \_\_\_\_\_"). Alternatively the classification may be indicated by a (U), (C), or (S) alongside each item as appropriate.

2. *Item 1:* Enter the Government assigned alphanumeric equipment designation. Use the official designation as it appears or will appear on the nameplate of the receiver (e.g., 2278). If a Government nomenclature has not been designated, enter the manufacturer's model number (e.g., NRD 1130BF). If neither a Government nomenclature nor a manufacturer's model number has been designated, enter a short descriptive title (e.g., ATS-6 Telemetry Receiver).

3. *Item 1a:* Enter the manufacturer's name. In those cases where a Government nomenclature has not been entered in Item 1, this item is mandatory.

4. *Item 2:* Enter the system nomenclature. The system nomenclature is defined as that nomenclature which has been assigned to a combination of equipments (e.g., AN/GRC-27).

5. *Item 3:* Enter the generic class or grouping of the receiver (e.g., Dual Conversion Super Heterodyne Receiver, Homodyne, etc.).

6. *Item 4:* Enter the actual frequency range through which the receiver can tune. For single frequency equipment, enter the frequency to which equipment is limited. Indicate units used (e.g., kHz, MHz, GHz, etc.).

7. *Item 5:* Enter the method of tuning (e.g., continuous, fixed, crystal synthesizer, etc.).

8. *Item 6:* Enter the total number of channels, frequency of the lowest channel, frequency of the highest channel, channel spacing, and if the device is capable of automatically hopping frequency (e.g., 10 channels, 406.125-406.350 MHz, 25 kHz spacing, with automatic frequency hopping capability).

9. *Item 7:* Enter the maximum departure of a receiver from its tuned frequency, after normal warmup time has been allowed. Express in parts per million for all emission types, except single sideband which shall be expressed in Hertz.

10. *Item 8:* Enter the emission designator(s) identifying the types of emission for which this receiver is designed.

11. *Item 9:* Enter the RF bandwidths at the -3, -20, and -60 dB levels for all receivers. The RF bandwidth includes any significant attenuation contributed by filtering in the input circuit or transmission line. Values of emission bandwidth specified should be indicated as calculated or measured by checking the appropriate block. Indicate units used (e.g., kHz, MHz, etc.).

12. *Item 10:* List the IF bandwidths at the -3, -20, and -60 dB levels for the first IF amplifier. If additional IF amplifiers are employed, list these levels for second, third IF's in the Remarks section (Item 20). Indicate units used (e.g., kHz, MHz, etc.).

13. *Item 11:* For digital equipment, enter the maximum bit rate (bps) that can be used. If spread spectrum is used, enter the bit rate after decoding. Describe any error detecting/correcting codes in the Remarks section (Item 20).

14. *Item 12:* List the maximum post detection frequency. This frequency is the nominal frequency that is 3 dB down on the high-frequency side of the receiver baseband. Indicate units used (e.g., kHz, MHz, etc.).

15. *Item 13:* For frequency modulated receivers, indicate whether de-emphasis is available.

16. *Item 14:* For multichannel FM systems, list the minimum post detection frequency. This frequency is the nominal frequency that is 3 dB down on the low-frequency side of the receiver baseband. Indicate units used (e.g., Hz, kHz, etc.).

17. *Item 15:* Enter the frequency of the first IF. If additional IF's are used, list the frequencies in the Remarks section (Item 20). Indicate units used (e.g., kHz, MHz, etc.).

18. *Item 16(a):* Enter the sensitivity in -dBm.

19. *Item 16(b):* Specify criteria used. For

example: -100 dBm for a 6 dB S/N ratio, -110 dBm for 12 dB SINAD:

$$\frac{\text{Signal} + \text{Noise} + \text{Distortion}}{\text{Noise} + \text{Distortion}}$$

20. *Item 16(c)*: Enter receiver noise temperature in Kelvins or receiver noise figure in dB.

21. *Item 17*: Check the appropriate block to indicate the location of the oscillator frequency with respect to the tuned frequency. If additional oscillators are used (i.e., additional IF stages), indicate the location of those oscillator frequencies in the Remarks section (Item 20).

22. *Item 18*: Enter the spurious rejection in dB. Enter the single level of spurious rejection that the receiver meets or exceeds at all frequencies outside the -60 dB IF bandwidth. Spurious rejection is the ratio of the input signal at a particular out-of-band frequency required to produce a specified output, to the desired signal required to produce the same output.

23. *Item 19*: Enter the image rejection in dB. Image rejection is the ratio of the input signal level at the image frequency required to produce a specified output, to the desired signal level required to produce the same output.

24. *Item 20*: Use this space to amplify any of the information provided above. Particular emphasis should be placed on a thorough explanation of the emission characteristics. This information might include system demultiplexing capabilities and details of composite systems (a "9" in the emission designator). It might also include such items as the characteristics of interference or noise suppression devices or unique signal processing techniques such as phase lock loops, optical correlators, etc. Any technical limitations integral to the equipment, which limit its performance over the frequency range or the use of specified emissions should be explained.

### 10.7.9 Instructions for Completing the Antenna Characteristics Form (NTIA-35)

1. *Security Classification*: This form will be classified in accordance with appropriate agency security directions. Downgrading instructions will be indicated. The items or relationship of items which make this completed form classified will be stated in the remarks section (e.g., "The association of the frequency range and the equipment nomenclature are classified \_\_\_\_\_"). Alternatively the classification may be indicated by a(U), (C), or (S) along-side each item as appropriate.

2. *Item 1*: Enter the Government assigned alphanumeric equipment designation. Use the official designation as it appears or will appear on the nameplate of the receiver (e.g., AT197). If a Government nomenclature has not been designated, enter the manufacturer's model number (e.g., DS 6558). If neither a Government nomenclature nor a manufacturer's model number has been designated, enter a short descriptive title (e.g., ATS-6 Telemetry Antenna).

3. *Item 1a*: Enter the manufacturer's name. In those cases where a Government nomenclature has not been entered in Item 1, this item is mandatory.

4. *Item 2*: Enter the system nomenclature. The system nomenclature is defined as that nomenclature which has been assigned to a combination of equipments (e.g., AN/GRC-27).

5. *Item 3*: Enter the generic name or describe general technical features (e.g., Horizontal Log Periodic; Cassegrain with polarization twisting; Omnidirectional). Include the antenna dimensions in meters when available.

6. *Item 4*: Enter the range of frequencies for which it is designed. Indicate units used (e.g., kHz, MHz, etc.).

7. *Item 5*: Enter the polarization. If circular, indicate whether it is left or right hand.

8. *Item 6(a)*: Enter the maximum gain in dB above isotropic.

9. *Item 6(b)*: Enter the maximum gain of the first major side lobe in dB above isotropic and the angular displacement from the main beam.

10. *Item 7(a)*: If this antenna scans, enter the type of scanning (e.g., vertical, horizontal, verti-

cal and horizontal, etc.).

11. *Item 7(b)(1)*: Enter the maximum elevation angle in degrees that the antenna can scan.

12. *Item 7(b)(2)*: Enter the minimum elevation angle in degrees that the antenna can scan.

13. *Item 7(b)(3)*: Enter the scanning rate in scans per minute.

14. *Item 7(c)(1)*: Enter the angular scanning range of the sector scanned, in degrees.

15. *Item 7(c)(2)*: Enter the scan rate in scans per minute.

16. *Item 8*: Enter the 3 db beamwidth in degrees.

17. *Item 9*: Use this item to describe any unusual characteristics of the antenna, particularly as they relate to the assessment of electromagnetic compatibility. Use this item to amplify or clarify Items 1 through 8. Radiation diagrams should be attached, if available.

**Form NTIA-33**

(FULL PAGE ART)



**Form NTIA-34**

(FULL PAGE ART)



**Form NTIA-35**

(FULL PAGE ART)



## 10.8 TRUNKED LAND MOBILE DATA REQUIREMENTS

### 10.8.1 Requests for New Trunked Systems

Requests for spectrum certification of new trunked land mobile systems shall contain the following information:

1. *Operating Location:* Provide the city (or other geographic subdivision) and state.

2. *Equipment Identification:* Provide the manufacturer and model number/name of the equipment.

3. *Docket Number of Previous Certification:* Provide the SPS docket number of the NTIA Certification of Spectrum Support for the equipment. (Agencies may obtain this information from the SPS Secretary, who maintains a list of approved trunking systems and associated docket numbers.) If the equipment has not received NTIA Certification of Spectrum Support, provide the equipment characteristics identified in Section 10.7.6 as an attachment.

#### 4. *System Overview*

- a. *Radio Crosspatches:* (Yes/No). If yes, explain.
- b. *Cross-Band:* (Yes/No). If yes, explain.
- c. *Voting:* (Yes/No). If yes, explain.
- d. *Number of Repeater Sites:* If more than one, explain.
- e. *Number of Telephone Interconnects:*
- f. *Line Diagram:* Provide a line diagram representing the system configuration and method of connecting multiple sites.
- g. *Other:* Provide any other system information.

5. *Coverage Information.* Provide the following for each repeater site:

- a. *Number of Repeaters at Site:*
- b. *Geographical Coordinates:* (in degrees, minutes, and seconds)

c. *Site Elevation:* (in meters above mean sea level)

d. *Antenna Height:* (in meters above site elevation)

e. *Antenna Gain:* (in dBi)

f. *Transmitter Power:* (in watts)

g. *Radius of Operation:* (in kilometers)

OR

*Geographical Plot of Required Coverage Area:*

#### 6. *Frequency Requirements*

a. *Frequency Band:*

b. *Narrowband Capability:* (Yes/No).

c. *Number of Channels (Frequency Pairs)*

*Required:*

d. *Rationale for Number of Channels:*

7. *System Use.* Identify each user type (e.g., administrative, fire, law enforcement, medical, security) supported by this system, and provide the following information for each user type:

a. *Number of Mobiles:*

b. *Number of Portables:*

c. *Number of Land Stations:*

#### 8. *Target Date for System Activation:*

#### 9. *Frequency Assignments to Be Replaced by this System*

a. *Assignments to Be Relinquished:*

Provide the existing Assigned Frequencies, Agency Serial Numbers, and Expected Relinquishment Date.

b. *Assignments to Be Used by the Trunked System:* For each existing frequency assignment that will be incorporated into the trunked system, provide the existing Assigned Frequencies and Agency Serial Numbers.

#### 10. *Availability of Commercial Services*

a. *Commercial SMR or Cellular Services Available:* (Yes/No).

b. *Justification for Non-Use:*

#### 11. *Sharing Availability*

- a. *System Available for Sharing by Other Federal Agencies:* (Yes/No).
- b. *Rationale for Non-Availability:*

12. *Estimated Initial Cost of the System:*

13. *Separate System Justification:* For trunked land mobile systems that are within 30 km of and existing or planned trunked land mobile system authorized by NTIA, provide the information required under subparagraph 8.48a.

### 10.8.2 Requests for Expansion/Additional Channels

Requests for expansion or additional channels for previously certified trunked land mobile systems shall contain the following information:

1. *Operating Location:* Provide the city (or other geographic subdivision) and state.
2. *Docket Number of Previous Certification:* Provide the SPS docket number of the NTIA Certification of Spectrum Support for the existing trunked system.
3. *Additional Frequency Requirements*
  - a. *Number of Additional Channels (Frequency Pairs) Required:*
  - b. *Rationale for Additional Number of Channels:* (e.g., channel loading, queuing times, usage report).
4. *Details of Expansion*
  - a. *Additional Repeater Sites:* Provide the information listed in Section 10.8.1, paragraphs 5a-5g, for each additional repeater site.
  - b. *Additional Users:* Provide the information listed in Section 10.8.1, paragraphs 7a-7c, for additional users.
5. *Target Date for Expansion/Additional Channels Activation:*

6. *Estimated Cost of this Expansion:*

### 10.8.3 Trunked System Usage Reports

Trunked system usage reports shall contain the following information:

1. *Operating Location:*
2. *SPS Docket Number of Certification of Spectrum Support:*
3. *Date of Activation:* (if the system is not yet activated, insert the proposed date of activation and provide all applicable frequency assignments serial numbers).
4. *System Information*
  - a. *Number of Base Station Locations:*
  - b. *Number of Frequencies Used:*
  - c. *Number of Land Stations:*
  - d. *Number of Mobiles:*
  - e. *Number of Portables:*
  - f. *Description of Users:*
  - g. *Number of Base Station Repeaters Equipped for Telephone Interconnect:*
5. *Data on Busiest Hour.* Specify the busiest hour and the time frame over which the following calculations were made:
  - a. *Number of Dispatch Calls:*
  - b. *Number of Telephone Calls:*
  - c. *Average Duration of Dispatch Call:*
  - d. *Average Duration of Telephone Call:* (if any)
  - e. *Number of Dispatch Call Busys:* (if any)
  - f. *Average Delay for Dispatch Calls:* (if any)
6. *Other Federal Agencies Using this System:* (if any)
7. *Additional Comments:*



**10.8.4 Guidelines Regarding Certification of Spectrum Support and Usage Reports for Trunked Systems**

1. Certifications of spectrum support for trunked systems with a date of activation exceeding one year from the date of certification will included a recommendation that record note S321 be applied to the corresponding requests for frequency assignment.

2. The SPS, after its periodic review of trunked system usage reports, will consider whether record note S321 should be applied to existing frequency assignments for systems not activated within one year from the date of certification.

3. The SPS will review the certification of spectrum support for each trunked system not activated within five years from the date of certification. Unless the responsible agency submits adequate justification for an extension of the activation time limit, the SPS will recommend to NTIA that the certification and all associated frequency assignment be revoked.

**10.9 LAND MOBILE SYSTEM DATA REQUIREMENTS**

An agency choosing to submit a conventional land mobile system for spectrum certification shall, for land mobile systems that are within 30 km of an existing or planning trunked land mobile system authorized by NTIA, provided the information required under subparagraph 8.2.48a.

**(Last Page in Chapter 10)**